

Volume 50 July–December 1984

Philosophical Magazine

First Published in 1798

Physics of Condensed Matter

A Defects and Mechanical Properties

B Electronic Optical and Magnetic Properties



Europhysics Journal



Taylor & Francis
London and Philadelphia

PHILOSOPHICAL MAGAZINE

Editor

Professor E. A. Davis

Department of Physics, University of Leicester, U.K.

Associate Editors

Dr S. R. Elliott

Department of Physical Chemistry,
University of Cambridge, U.K.

Professor A. J. Forty

Department of Physics, University of Warwick, U.K.

Dr M. J. Goringe

Department of Metallurgy and Science of Materials,
University of Oxford, U.K.

Dr P. M. Hazzledine

Department of Metallurgy and Science of Materials,
University of Oxford, U.K.

Regional Editors

Professor C. Domb

Department of Physics, Bar-Ilan University, Israel

Dr M. Duesbury

Division of Physics, National Research Council, Canada

Dr M. Kléman

Laboratoire de Physique des Solides,
Université de Paris-Sud, France

Professor K. Morigaki

Institute of Solid State Physics, University of Tokyo, Japan

Dr C. Schlenker

Laboratoire d'Études des Propriétés Électroniques des
Solides, CNRS-Grenoble, France

Professor A. Seeger

Institut für Physik, Max-Planck-Institut für Metallforschung
Stuttgart, F.R. Germany

Dr R. A. Street

Palo Alto Research Center, Xerox Corporation, U.S.A.

Consultant Editor

Professor Sir Nevill Mott

Cavendish Laboratory, University of Cambridge, U.K.

Book Review Editor

Dr E. Marseglia

Cavendish Laboratory, University of Cambridge, U.K.

Subscription Information

Published monthly Annual subscription 1985 £224 DM 1008 US \$620 ISSN 0141-86

Dollar rates apply to USA, Canada and Mexico. Deutschmark rates to FR Germany. Sterling rates apply to the UK and all other areas.

All subscriptions are payable in advance and all rates include postage. Journals are sent by air to USA, Canada and Mexico, India and Australasia. Subscriptions are entered on an annual basis, from January to December. Payment may be made by sterling cheque, dollar cheque, international money order or National Giro, or by credit card (AMEX, VISA, Mastercard/Access).

Orders originating in the following territories should be sent direct to the local distributors

USA, Canada and Mexico	Taylor & Francis Inc, 242 Cherry Street, Philadelphia, Pennsylvania 19106-1906.
Japan	Kinokuniya Company Ltd, Odakyu West-Shinjuku Building, 4F, Hatsudai 1-chrome, Shibuya-ku, Tokyo 151.
India	Universal Subscription Agency Pvt. Ltd, 117/H-1/294B Model Town, Pandu Nagar, Kanpur 208 025.
UK and all other territories	Taylor & Francis Ltd, Rankine Road, Basingstoke, Hampshire RG24 0PR.

Air freight and mailing in the USA by Publication Expediting Inc., 200 Meacham Avenue, Elmont, New York 11003. Second class postage paid at Jamaica, New York 11431. US Postmaster: Send address changes to *Philosophical Magazine*, Publications Expediting Inc., 200 Meacham Avenue, Elmont, New York 11003.

Published by Taylor & Francis Ltd, 4 John Street, London WC1N 2ET, UK. Printed by Taylor & Francis (Printers) Ltd, Rankine Road, Basingstoke, Hampshire RG24 0PR, UK.

CONTENTS OF VOL. 50 Nos 1-6

NUMBER 1—JULY

PART A

PAGE

Letters Section :

Two independent mechanisms of dynamical recovery in the high-temperature deformation of silicon and germanium

By H. SIETHOFF, K. AHLBORN and W. SCHRÖTER L1

On the origin of the additional electron diffraction spots from epitaxial (111) Si single-crystal films

By Y. LEREAH and E. GRÜNBAUM 1

Effect of creep substructure on the stress exponent of Al following stress reductions

By T. J. GINTER, M. S. SOLIMAN and F. A. MOHAMED 9

Relationship between the form of zone-axis patterns for HEED and the crystal potential of transition-metal dichalcogenides

By K. K. FUNG and J. W. STEEDS 25

A simple empirical *N*-body potential for transition metals

By M. W. FINNIS and J. E. SINCLAIR 45

Solid-solid phase transitions in a low-dimensionality system

By A. BONISSENT, P. PIERANSKI and P. PIERANSKI 57

Anti-phase boundary energy in β -CuZn

By H. SAKA, M. KAWASE, A. NOHARA and T. IMURA 65

Study of constitutional and thermally created lattice defects in the β' -PdIn phase

By H. G. MÜLLER and H. HAHN 71

The annealing of vacancy defects in β -NiAl. I. Vacancy loop growth in as-grown single crystals annealed in ultra-high vacuum

By A. PARTHASARATHI and H. L. FRASER 89

The annealing of vacancy defects in β -NiAl. II. The role of surface oxidation in vacancy loop growth in slowly cooled crystals

By A. PARTHASARATHI and H. L. FRASER 101

High-resolution images of planar faults and domain structures in the σ phase of an iron-base superalloy

By H. Q. YE and K. H. KUO 117

Electron diffraction from microtwins and long-period polytypes

By C. B. CARTER 133

PART B

	PAGE
Letters Section:	
The orientational correlation tensor in ice I, III, IV, V and VI By G. P. JOHARI, S. J. JONES and J. PEREZ	L1
The effect of temperature-dependent energies on semiconductor thermo-power formulae By P. N. BUTCHER	L5
The loss of ferromagnetism in $Gd(X)Al_2$, where X is U, Th or La By B. R. COLES, J. Y. PING and M. H. BENNETT.....	1
The relationship between space-charge-limited current and density of states in amorphous silicon By J. W. ORTON and M. J. POWELL	11
Compton profile studies of amorphous and polycrystalline arsenic By I. THEODORIDOU and N. G. ALEXANDROPOULOS.....	23
Recombination and excited-state absorption at photoluminescence centres in crystalline and amorphous arsenic triselenide By L. H. ROBINS and M. A. KASTNER	29
Generalization of a new approach to the retrieval of angle-resolved single-loss profiles By P. SCHATTSCHNEIDER and G. SÖLKNER.....	53
Low-temperature thermoelastic effects in glasses By O. B. WRIGHT and W. A. PHILLIPS	63
The electronic properties of charged dislocations in semiconductors By H. VETH and M. LANNOO	93
On the electronic structure of molten Si By J. P. GASPARD, PH. LAMBIN, C. MOUTTET and J. P. VIGNERON	103
Impurity conduction in silicon and effect of uniaxial compression on p-type Si By J. A. CHROBOCZEK, F. H. POLLAK and H. F. STAUNTON	113
Book reviews	157

NUMBER 2—AUGUST

PART A

A calculation of the formation energies of intrinsic defects near grain boundaries in NiO By D. M. DUFFY and P. W. TASKER	143
---	-----

	PAGE
A calculation of the interaction between impurity ions and grain boundaries in NiO	
By D. M. DUFFY and P. W. TASKER	155
Stacking-fault energy of II-VI compounds	
By S. TAKEUCHI, K. SUZUKI, K. MAEDA and H. IWANAGA	171
Effet de l'interférence interprécipité sur la résistivité électrique dans les alliages Al-Zn	
Par G. VIGIER, J. MERLIN et C. MAI	179
Weak-beam study of dislocations moving on {100} planes at 800°C in Ni₃Al	
By P. VEYSSIÈRE	189
Plastic deformation of Ni₂AlTi	
By M. YAMAGUCHI, Y. UMAKOSHI and T. YAMANE	205
A lattice imaging study of nitrogen precipitation in α-iron and Fe-2.17 at.% Mn	
By P. FERGUSON and K. H. JACK	221
High-pressure-induced defect formation in silicon single crystals. I. Characterization of defects and conditions of their creation	
By J. JUNG and M. LEFELD-SOSNOWSKA	233
High-pressure-induced defect formation in silicon single crystals. II. Mechanism of stress-field formation at precipitates	
By J. JUNG	257
Dislocation structures in copper single crystals fatigued at low amplitudes	
By L. BUCHINGER, S. STANZL and C. LAIRD	275

PART B

Special Issue

Bar-Ilan Conference 1983

Editorial

Metal-insulator transitions	
By N. F. MOTT	161
Diffusion near the metal-insulator transition	
By G. A. THOMAS	169
Localization in disordered systems	
By M. KAVEH	175
Dielectric function near a polarization catastrophe	
By R. N. BHATT	189
Interaction effects in disordered conductors near the metal-insulator transition	
By Y. IMRY and Y. GEFEN	203

	PAGE
Observation of a scale-dependent quantum diffusion near the metal-insulator transition By I. SCHWARTZ, S. SHAFT, A. MOALEM and Z. OVADYAHU	221
Localization, eigenstates and resonances in random systems By M. YA. AZBEL	229
Fractional dimensionality of localization and quantum Hall current relaxation By M. YA. AZBEL and M. H. BRODSKY	237
Anderson transition in a magnetic field. A possible phase diagram By B. SHAPIRO	241
Enhancement of susceptibility and the electrical resistivity of organic metals with a small mean free path By O. ENTIN-WOHLMAN, M. KAVEH, H. GUTFREUND, M. WEGER and N. F. MOTT	251
Non-ergodic behaviour of Anderson insulators with and without Coulomb interactions By M. POLLAK	265
Low-temperature studies of random Ising models By C. DOMB and O. ENTIN-WOHLMAN	273
Critical line for irreversibility in spin glasses By Y. YESHURUN	285
Infinitely ramified fractal lattices and percolation By D. BEN-AVRAHAM, S. HAVLIN and D. MOVSHOVITZ	297
Percolation theoretical treatment of two-dimensional fragmentation in solids By R. ENGLMAN, Z. JAEGER and A. LEVI	307
Book reviews	317

NUMBER 3—SEPTEMBER

PART A

The sputtering of gold single crystals by Ar⁺ ions By S. AHMAD and M. W. THOMPSON	299
The structure of moving grain boundaries in aluminium as revealed by synchrotron X-ray topography By J. GASTALDI and C. JOURDAN	309
The numbers of critical nuclei and embryos for coherent precipitation of a new phase of different composition By T. KAMIJO and H. FUKUTOMI	319
Hexagonal germanium and high-resolution electron microscopy By J. R. PARSONS and C. W. HOELKE	329

	PAGE
Work-hardening of dispersion-strengthened disordered $\text{Cu}_3\text{Au-SiO}_2$ single crystals	
By A. J. ARDELL and S. PATTANAIK	339
Work-hardening of dispersion-strengthened ordered $\text{Cu}_3\text{Au-SiO}_2$ single crystals	
By A. J. ARDELL and S. PATTANAIK	361
Methods for the measurement of rigid-body displacements at edge-on boundaries using high-resolution electron microscopy	
By G. J. WOOD, W. M. STOBBS and D. J. SMITH.....	375
Mechanical behaviour associated with the premartensitic rhombohedral-phase transition in a $\text{Ti}_{50}\text{Ni}_{47}\text{Fe}_3$ alloy	
By S. MIYAZAKI and K. OTSUKA	393
As segregation to grain boundaries in Si	
By C. R. M. GROVENOR, P. E. BATSON, D. A. SMITH and C. WONG ...	409
Hardening of NaCl single crystals induced by Eu obstacles	
By E. OROZCO M., J. SOULLARD, C. ZALDO and F. AGULLÓ-LÓPEZ.....	425
On the interpretation of diffuse scattering in electron diffraction patterns of metal carbides M_7C_3 ($\text{M}=\text{Fe}, \text{Mn}, \text{Cr}$)	
By J. MAHY, D. VAN DYCK and S. AMELINCKX	441

PART B

Letters Section:

The electronic structure of defects in amorphous GaAs	
By E. P. O'REILLY and J. ROBERTSON	L9
An assessment of the structural models for amorphous SiO using MAS NMR	
By R. DUPREE, D. HOLLAND and D. S. WILLIAMS	L13
Measurements of the electron density in n-type a-Si : H	
By R. A. STREET and J. ZESCH	L19
The structure of vitreous and liquid V_2O_5	
By A. C. WRIGHT	L23
On the temperature dependence of electron transport by small-polaron motion	
By C. M. HURD.....	L29
Majority and minority carrier lifetimes in doped a-Si junctions and the energy of the dangling-bond state	
By W. E. SPEAR, H. L. STEEMERS, P. G. LE COMBER and R. A. GIBSON	L33
Specific heat of magnetite near the Verwey transition. Is there more than one phase transition?	
By E. GMELIN, N. LENGE and H. KRONMÜLLER	L41

	PAGE
Evidence for a charge-density-wave instability in the purple bronze $K_{0.9}Mo_6O_{17}$ By C. ESCRIBE-FILIPPINI, K. KONATÉ, J. MARCUS, C. SCHLENKER, R. ALMAIRAC, R. AYROLES and C. ROUCAU	321
Stabilization of the Fermi level in photochromic glasses By R. J. ARAUJO, N. F. BORRELLI and D. A. NOLAN	331
High pressure studies of $Se_{100-x}Te_x$ glasses By G. PARTHASARATHY, K. J. RAO and E. S. R. GOPAL	335
Charge transport in molecularly doped polymers By H. BÄSSLER	347
A model for coordination in random close packing By D. E. G. WILLIAMS	363
Transient photoluminescence and photo-induced optical absorption in polymeric and crystalline sulphur By S. ODA, M. A. KASTNER and E. WASSERMAN	373
Computer simulation of a two-dimensional soap froth. II. Analysis of results By D. WEAIRE and J. P. KERMODE	379
Spin-dependent hole diffusion in a-Si : H By H. DERSCH and L. SCHWEITZER	397
Book reviews	405

NUMBER 4—OCTOBER

PART A

Letters Section :

Atomic configurations of disclinations by computer simulation By M. DOYAMA and R. M. J. COTTERILL	L7
Point-defect clouds at low-angle boundaries in cadmium sulphide By O. F. VYVENKO and W. SCHRÖTER	L11
Precipitation and dissolution of extended defects in chromia-doped rutile By L. A. BURSILL, M. G. BLANCHIN and D. J. SMITH	453
The structure of extended defect terminations in rutile By D. J. SMITH, L. A. BURSILL and M. G. BLANCHIN	473
A study of slip nucleation in Fe-3.5% Si single crystals by synchrotron radiation topography By M. DUDLEY, J. MILTAT and D. K. BOWEN	487
Solute-enhanced self-diffusion. II. An improved calculation of enhancement factors By S. ISHIOKA and M. KOIWA	505

	PAGE
A HREM study of domain structures in the H phase coexisting with the σ phase in a nickel-based alloy By D. X. LI, H. Q. YE and K. H. KUO	531
Specific heat and surface melting of sodium By G. FRITSCH, H. DILETTI and E. LÜSCHER	545
Diffusion kinetics and correlation effects for self-diffusion via vacancy pairs and triple defects in the sphalerite structure By D. WEILER, H. MEHRER and N. A. STOLWIJK	559
Fourth-order invariants for the Landau free-energy expansions of elastic phase transitions By J. K. LIAKOS and G. A. SAUNDERS	569

PART B

Letters Section :

Scaling theory applied to strong and weak pinning in ferromagnets By P. GAUNT	L45
TEM cathodoluminescence study of recombination behaviour at dislocations in indium phosphide By H. J. HUTCHINSON and S. MYHAJLENKO	L49
Numerical investigation of non-Ohmic hopping conduction in disordered systems By H. BÖTTGER and D. WEGENER	409
Does the flexibility of ferromagnetic domain walls affect their mobility ? By E. NEMBACH and W. RIEHEMANN	421
Effect of uniaxial stress on the acceptor ground state and on hopping conduction in p-type germanium and silicon By R. BUCZKO and J. A. CHROBOCZEK	429
Reversible photodarkening and structural changes in As₂S₃ thin films By M. FRUMAR, A. P. FIRTH and A. E. OWEN	463
The measurement of low-angle structure factors of Cu₃Au by high energy electron diffraction By A. G. FOX	477
Transport properties of hydrogenated and chlorinated amorphous silicon. Correlation with infrared transmission spectra By S. AL DALLAL, S. KALEM, J. BOURNEIX, J. CHEVALLIER and M. TOULEMONDE	493
A Monte Carlo simulation of precipitation phenomena in a diamond lattice By A. DESALVO and G. RUANI	505

	PAGE
Annealing and crystallization processes in tetrahedrally bonded binary amorphous semiconductors By A. MORIMOTO, T. KATAOKA, M. KUMEDA and T. SHIMIZU	517
Book reviews	539

NUMBER 5—NOVEMBER

PART A

Obituary: W. H. Taylor

Letters Section:

The image force on the dislocation near a finite length crack tip By C. W. LUNG and L. WANG	L19
Simultaneous observation of α - and β -dislocation movement and their effect on the fracture behaviour of GaAs By P. D. WARREN, P. PIROUZ and S. G. ROBERTS	L23
Conductivity correlation in systems of non-interacting particles By J. C. DYRE	585
Diffusion of ^{60}Co in $(\text{Co}_{0.8}\text{Fe}_{0.2})_3\text{V}$ alloys in the ordered and disordered states By S. MANTL, S. J. ROTHMAN, L. J. NOWICKI and D. BRASKI	591
Phenomenological coefficients calculated from linear response expressions for the dissociative model of atom transport in a dilute f.c.c. alloy By Y. OKAMURA and A. R. ALLNATT	603
Ferroelastic character and study by HREM of the mechanism of the hexagonal-monoclinic phase transition of rare earth sesquioxides By M. BEN SALEM, R. DORBEZ, B. YANGUI and C. BOULESTEIX	621
Positron annihilation studies of electron-irradiated, cold-worked and hydrogen-charged nickel By C. S. SUNDAR, A. BHARATHI and K. P. GOPINATHAN	635
The effect of atomic order on the thermodynamic properties of the martensitic transformation in CuZn and CuZnAl alloys By J. VIÑALS, V. TORRA, A. PLANES and J. L. MACQUERON	653
High resolution and <i>in situ</i> investigation of defects in Bi-irradiated Si By M. O. RUAULT, J. CHAUMONT, J. M. PENISSON and A. BOURRET	667
The crystallography of annealing twins in alumina ceramics By Y. R. SHIUE and D. S. PHILLIPS	677

PART B

	PAGE
Obituary: W. H. Taylor	
Dislocation core structures in α quartz derived from a valence force potential By M. HEGGIE and M. NYLÉN	543
Amorphous structure and corrugated space. I. Theory By J. P. GASPARD, R. MOSSERI and J. F. SADOE	557
On the susceptibility behaviour of some two-dimensional spin canted antiferromagnets By M. M. ABDEL-KADER	569
Frequency-resolved spectroscopy and its application to the analysis of recombination in semiconductors By S. P. DEPINNA and D. J. DUNSTAN	579
Cathodoluminescence of hydrogen-doped MgO crystals thermochemically reduced at high temperatures By R. GONZÁLEZ, J. LLOPIS, C. BALLESTEROS and Y. CHEN	599
Anderson transition and intermediate polaron formation in WO_{3-x}. Transport properties and optical absorption By E. SALJE and B. GÜTTLER	607
Low-temperature a.c. conductivity of vanadium dioxide crystals By A. MANSINGH, A. K., SINHA P. N. DHEER and M. SAYER	621
Impurity promoted intergranular fracture By C. M. SAYERS	635
Book reviews	641

NUMBER 6—DECEMBER

PART A

Letters Section:

Spinodal decomposition in $\text{TiO}_2\text{-SnO}_2$ studied by 1 MV HRTEM By S. HORIUCHI, F. IZUMI, T. KIKUCHI and K. UCHIDA	L29
Internal friction in concentrated solid solutions By P. FELTHAM	L35
The matrix element for inelastic scattering by a crystal By C. D. MEEKISON and M. J. WHELAN	L39
Changes in stress intensity with dislocation emission from a crack By I.-H. LIN and J. P. HIRTH	L43

	PAGE
Compton profile anisotropy in Ni₃Ga	
By F. ITOH, M. COOPER, R. S. HOLT, D. LAUNDY, D. A. CARDWELL and N. KAWAMIYA.....	703
On deducing a unified growth model for the ω phase in β-III Ti from small-angle neutron scattering	
By M. FATEMI.....	711
Dissociated dislocations in GaAs observed in high resolution electron microscopy	
By M. TANAKA and B. JOUFFREY.....	733
Structure of AuGeAs determined by convergent-beam electron diffraction I. Derivation of basic structure	
By R. VINCENT, D. M. BIRD and J. W. STEEDS.....	745
Structure of AuGeAs determined by convergent-beam electron diffraction II. Refinement of structural parameters	
By R. VINCENT, D. M. BIRD and J. W. STEEDS.....	765
Self-diffusion processes in GaSb	
By D. SHAW	787
Dislocation loops in elastically anisotropic materials I. Small loops in β'-brass	
By A. J. MORTON	797
Modified Hertz theory for spherical indentation	
By E. H. YOFFE.....	813
Stress relaxation in dilute Al-0.02 at.% Mn alloy under electron irradiation	
By L. N. BYSTROV, L. I. IVANOV, M. N. PLETNEV and M. E. REZNITSKY	829
The measurement of impact parameters by crystallographic orientation effects in electron scattering	
By A. J. BOURDILLON.....	839
Reflection electron microscopy of epilayers grown by molecular beam epitaxy	
By B. C. DE COOMAN, K.-H. KUESTERS, C. B. CARTER, TUNG HSU and G. WICKS	849
Subject index	857
Index of authors (with titles).....	862
Index of book reviews	871

PART B

Letters Section:

**Combined tunnelling and SEM channelling analysis of metallic bilayers
Al(111) epitaxed on Nb(110)**

By H. J. TAO, E. D. GIBSON, J. D. VERHOEVEN and E. L. WOLF..... L55

	PAGE
Conduction-band tail width and minimum metallic conductivity in $a\text{-Si}_x\text{N}_{1-x}:\text{H}$ films studied by photoconduction and optical absorption By R. MEAUDRE and A. MEZHOUDI.....	L63
A.c. conductivity in binary $\text{V}_2\text{O}_5\text{-P}_2\text{O}_5$ glasses By L. MURAWSKI.....	L69
Hall coefficient of liquid Ga-Te alloys By H.-U. TSCHIRNER, K. UHLIG and M. WOBST.....	645
Mechanical relaxation in an ionic glass By C. MAÏ, S. ETIENNE, J. PEREZ and G. P. JOHARI.....	657
Suppression of antistructural defects in crystals by an increased polarization of bonds By J. HORÁK, P. LOŠŤÁK and L. BENEŠ.....	665
Infrared absorption studies of the annealing of irradiated diamonds By G. S. WOODS.....	673
The electrical conductivity and thermoelectric power of nickel ferrous ferrite. Magnetic ordering effects By T. E. WHALL, K. K. YEUNG, Y. G. PROYKOVA and V. A. M. BRABERS.....	689
Anomalous pressure response of luminescence in $c\text{-As}_2\text{S}_3$ and $a\text{-As}_2\text{SeS}_2$. Consequences for defect structure in chalcogenides By B. A. WEINSTEIN.....	709
Electronic transitions of high probability corresponding to X-ray absorption discontinuities. II By S. KAWATA and K. MAEDA.....	731
Book reviews.....	735
Subject index.....	739
Index of authors (with titles).....	744
Index of book reviews.....	753

